

Polymer Derived Yttrium Silicate Ablative TPS Materials for Next-Generation Exploration Missions, Phase I

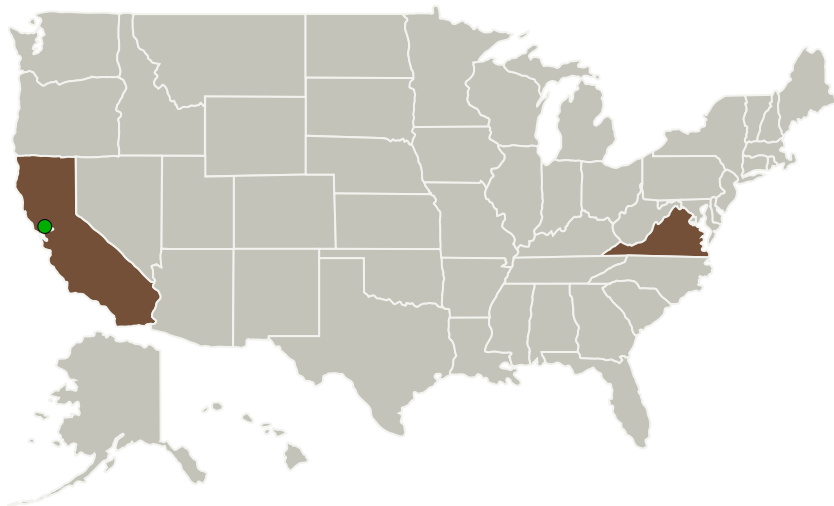
Completed Technology Project (2014 - 2014)



Project Introduction

Through the proposed NASA SBIR program, NanoSonic will optimize its HybridSil® derived yttrium silicates to serve as next-generation reinforcement for carbon and ceramic felt ablative TPS materials. This effort will leverage NanoSonic's rapidly evolving polymer derived ceramic technology, which has demonstrated thermomechanical durability in excess of 1900 oC, thermal conductivity as low as 30 mW/mK, erosion resistance to high velocity sand, and facile spray depositability under ambient conditions. NanoSonic's yttrium silicate TPS reinforcing matrices will be molecularly engineered to drastically outperform current char-forming carbon / phenolic materials during planetary entry while weighing and costing less by providing nanocomposite matrices with substantially enhanced 1) thermo-oxidative durability, 2) impact resilience, and 3) readily tailorable high temperature ablative recession rates . The driving optimization factors for phase I TPS materials will include interfacial covalent coupling to surface functionalized carbon and ceramic felts, bulk morphology of the host matrix, and composition of the yttrium silicate polymorph. Thermal loading on promising TPS materials simulating current and future Exploration missions will be completed by the University of Washington's high enthalpy test facility. In support of a phase III transition, NanoSonic has generated significant defense prime interest and has an established pilot scale HybridSil® manufacturing infrastructure.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Nanosonic, Inc.	Lead Organization	Industry	Pembroke, Virginia
● Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations	
California	Virginia

Project Transitions

**June 2014:** Project Start**December 2014:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/137593>)

Images



Briefing Chart

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(<https://techport.nasa.gov/image/129169>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Nanosonic, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

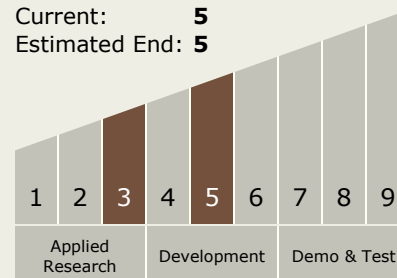
Carlos Torrez

Principal Investigator:

Victor V Baranauskas

Technology Maturity (TRL)

Start: 3
Current: 5
Estimated End: 5



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Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.3 Thermal Protection Components and Systems
 - └ TX14.3.1 Thermal Protection Materials

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System